REMARKS

Claims 1-5, 7-14 and 16-20, as amended, appear in this application for the Examiner's review and consideration. Claims 6 and 15 have been cancelled and all rejections based on those claims have been rendered moot. The independent claims have been amended to cover a preferred embodiment of the method that was previously recited in claim 7, wherein a stiffener is applied to the second face of the wafer prior to removing the remaining portion. Claims 8, 10, and 12-14 were amended to be consistent with amended claim 7. It is respectfully submitted that these changes do not raise any new issues or new matter so that they all should be entered at this time to reduce the issues for appeal by eliminating the current rejections. For the reasons that follow, applicants submit that the present claim amendments overcome all rejections and place the entire application in condition for allowance.

Before addressing the current rejections to confirm that they are not applicable to the present claims, a review of the invention may be helpful. The present claims are directed to the thinning of patterned wafers using implantation in the rear face of the semiconductor material to remove material from the rear face and to have very thin self supported layers, i.e., less than 30-35 μm (see specification paragraphs [0022] and [0030]) for supporting electronic components or circuits without damaging devices formed on the front face. Furthermore, to assist in the thinning of the rear face, a stiffener is applied to the second face of the wafer prior to removing the remaining portion. This preferred embodiment is disclosed in paragraphs [0098] to [0109] and [0112] to [0013] as well as in FIGS. 13 to 17 and is now claimed to facilitate prosecution of the present application. Applicants expressly reserve their right to present claims to the other disclosed features of the invention in a continuation or divisional application.

Claim 19 was rejected as being anticipated over Matsui et al. US patent 6,191,007 ("Matsui"). Matsui describes a method for transferring extremely thin patterned layers on a support. In all the different options presented in Matsui, the transferred thin layer has always a thickness only about 0.1 to 2 mm (see col. 15, lines 12-13). In most of the embodiments, an implantation is realized on the front face of the substrate that includes the components, and this face is masked to homogenize the thickness of the extremely thin layer that is transferred onto the support.

Although Matsui does have one embodiment where the wafer has components on its front side and the implantation is conducted through the rear face (see col. 35, lines 1-5) to form an ion implanted layer for detachment, this is done in order to avoid the use of a protection material ("ion implantation regulating material") which is usually included when the implantation occurs on the front face (see col. 34, lines 59-61 to col. 35, line 8). A layer is then transferred onto a supporting substrate by detaching the substrate at the weakened zone.

As explained in applicants' prior response, Matsui's thin transferred layer cannot be self-supporting like those of the present invention because it is too thin to be freestanding on its own and is always present with a supporting structure. Furthermore, Matsui does not apply a stiffener to the rear face for holding and manipulation of the structure prior to removal of the remaining portion. Furthermore, the attachment and detachment of the stiffener allows a portion of the wafer to be removed at one time and this is a faster and more effective removal of material compared to polishing or scrubbing.

Accordingly, the anticipation rejection based on Matsui has been overcome and should be withdrawn.

Claims 1-4, 7-11, 16-18 and 20 were rejected as being unpatentable over the combination of Matsui with Hanson et al. US patent 5,492,0764 ("Hanson") for the reasons set forth on pages 2-4 of the action. Applicants submit that this rejection is no longer applicable due to the present claim amendments.

Matsui is described above and applicants adopt those comments in response to this rejection. Hanson is apparently cited to remedy the deficiencies of Matsui.

Hanson describes a method of reclaiming donor substrates using a number of techniques including the well known SMART-CUT® process (see col. 3, lines 55-58). The rejected wafers are submitted to different processing steps for removing unwanted layers and then are thinned by chemical etching (see col. 3, lines 59-61) to remove metals and insulators; planarization (see col. 4, lines 7-19) to smooth the surface; and detachment of layers with the steps of the conventional SMART-CUT ® process (i.e., implantation, heating and detaching) for removing diffusion and buried oxides (see col. 4, lines 2-37).

Hanson is directed to the re-processing of defective or rejected wafers so that the wafers can be reused. Even though Hanson discloses that the different steps of the SMART-CUT® process can be repeated to remove layers (col. 4, lines 37-41), he explains

that it is the "conventional SMART-CUT ® process that is used, and skilled artisans readily understand that this means that the implantation occurs on the front face of the substrate not on the rear face as presently claimed. Furthermore, in the SMART-CUT ® process, a stiffener is applied to the front face of the wafer, and Hanson could not remove defective material with that process if the stiffener is applied to the rear (or second) face of the wafer.

Furthermore, if a stiffener is to be provided onto the front face of the wafer, this would have to be on top of the electronic circuit (when one is provided), and this presents a number of problems. If the stiffener is to be molecularly bonded, the electronic circuit must also be polished to be sufficiently smooth to bond to the stiffener. If an adhesive is to be used, the removal of the adhesive must be done carefully to avoid damage to the electronic circuit during such removal. More importantly, if the stiffener is applied to the front face of the wafer, it cannot be used to thin the wafer since it is the rear face of the wafer that is being thinned. The stiffener simply protects the circuit but does nothing to thin the layer that supports the electronic circuit.

There also is no reason or motivation for a skilled artisan to implant ions into the rear face of the substrate and to apply a stiffener on that face as presently claimed, and the skilled artisan would not have used Hanson's disclosure for this purpose. Instead of thinning a wafer on its rear face for forming a thin self supporting layer with electronic components or circuits, Hanson is removing such a layer because it contains defective material. As Hanson does not remedy the deficiencies of Matsui, this rejection should be withdrawn.

Claims 5, 6, and 12-14 were rejected over the prior combination with the addition of various selections of further references, such as Henley et al. US patent 6,291,314 ("Henley"); Kang et al. US patent 6,287,941 ("Kang"); Aspar et al. US patent 6,020,252 ("Aspar"); and Sayyah US patent application 2002-0055237. None of these references remedy the deficiencies of Matsui and Hanson as to independent claims 1, 19 or 20.

As previously noted, Henley describes a method for fabricating a film with active devices by transferring the layer from a donor substrate to a target substrate. In the same manner as the SMART-CUT® process, implantation of energetic species is realized through the front surface of the donor substrate (see col. 2, lines 50 and col. 13, lines 6-13). And to the extent that a stiffener is used, it is also applied to the front face after implantation.

Kang describes a method for treating a cleaved surface and or implanted surface with the combination of a thermal treatment and a chemical reaction. As the surface is cleaved, it does not include a temporary stiffener as in the present invention.

Aspar discloses the separation of a thin layer having electronic components from a substrate using implantation, heat treatment and mechanical forces. The implantation again occurs on the front face of the substrate (see Fig. 1 and col. 4 lines 19-21) and both the thin layer and stiffener which is applied on that same face are subsequently separated from the substrate by heating.

Sayyah describes the transfer of prefabricated devices and circuits from a original substrate to a new substrate.

In view of the above, this combination of references does not result in the presently claimed invention, and these secondary rejections based on these combinations of references should be withdrawn.

Turning now to the Examiner's comments on applicants' prior amendments, a statement was made that the thickness of the thin layer is not recited in the claims. In response, claim 20 has been amended to more clearly recite this feature.

The Examiner's comments regarding the Matsui patent are not correct, but the independent claims now recite the application of a stiffener to the face of the wafer that is desired to be thinned. Matsui has no such disclosure, and none of the secondary references supply this missing disclosure.

Accordingly, it is believed that the entire application is now in condition for allowance, early notice of which would be appreciated. Should the Examiner disagree, then a personal or telephonic interview is respectfully requested to discuss any remaining issues and expedite the eventual allowance of the application.

Respectfully submitted,

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